Boilermakers

(O*NET 89135)

Significant Points

- A formal apprenticeship is the best way to learn this trade.
- Due to the limited number of apprenticeships available and relatively good wages, prospective boilermakers may face competition.

Nature of the Work

Boilermakers and boilermaker mechanics make, install, and repair boilers, vats, and other large vessels that hold liquids and gases. Boilers supply steam to drive huge turbines in electric power plants and to provide heat and power in buildings, factories, and ships. Tanks and vats are used to process and store chemicals, oil, beer, and hundreds of other products.

Boilers and other high-pressure vessels are usually made in sections, by casting each piece out of molten iron or steel. Manufacturers are increasingly automating this process to increase the quality of these vessels. Boiler sections are then welded together, often using automated orbital welding machines, which make more consistent welds than are possible by hand. Small boilers may be assembled in the manufacturing plant; larger boilers are usually assembled on site.

Following blueprints for installing boilers and other vessels, boilermakers locate and mark reference points on the boiler foundation, using straightedges, squares, transits, and tape measures. Boilermakers attach rigging and signal crane operators to lift heavy frame and plate sections and other parts into place. They align sections, using plumb bobs, levels, wedges, and turnbuckles. Boilermakers use hammers, files, grinders, and cutting torches to remove irregular edges so edges fit properly. Then they bolt or weld edges together. Boilermakers align and attach water tubes, stacks, valves, gauges, and other parts and test complete vessels for leaks or other defects. Usually they assemble large vessels temporarily in a fabrication shop to insure a proper fit before final assembly on the permanent site.

Because boilers last a long time—35 years or more—boilermakers regularly maintain them and update components such as burners and boiler tubes to increase efficiency. Boilermaker mechanics maintain and repair boilers and similar vessels. They inspect tubes, fittings, valves, controls, and auxiliary machinery and clean or supervise the cleaning of boilers. They repair or replace defective parts, using hand and power tools, gas torches, and welding equipment, and may operate metalworking machinery to repair or make parts. They also dismantle leaky boilers, patch weak spots with metal stock, replace defective sections, and strengthen joints.

Boilermakers maintain and repair boilers and similar vessels.

Working Conditions

Boilermakers often use potentially dangerous equipment, such as acetylene torches and power grinders, handle heavy parts, and work on ladders or on top of large vessels. Work may be done in cramped quarters inside boilers, vats, or tanks that are often damp and poorly ventilated. To reduce the chance of injuries, boilermakers may wear hardhats, harnesses, protective clothing, safety glasses and shoes, and respirators. Boilermakers usually work a 40-hour week but may experience extended periods of overtime when equipment is shut down for maintenance. Overtime work may also be necessary to meet construction or production deadlines.

Employment

Boilermakers held about 18,000 jobs in 1998. Well over half worked in the construction industry, assembling and erecting boilers and other vessels. About one-fifth worked in manufacturing, primarily in boiler manufacturing shops, iron and steel plants, petroleum refineries, chemical plants, and shipyards. Some also work for boiler repair firms, railroads, or in Navy shipyards and Federal power facilities.

Training, Other Qualifications, and Advancement

Most training authorities recommend a formal apprenticeship to learn this trade. Some people become boilermakers by working as helpers to experienced boilermakers, but generally lack the wide range of skills acquired through an apprenticeship. Apprenticeship programs usually consist of 4 years of on-the-job training, supplemented by about 144 hours of classroom instruction each year in subjects such as set-up and assembly rigging, welding of all types, blueprint reading, and layout. Experienced boilermakers often attend apprenticeship classes to keep their knowledge current.

When an apprenticeship becomes available, the local union publicizes the opportunity by notifying local vocational schools and high school vocational programs. Qualified applicants take an aptitude test administered by the union, specifically designed for boilermaking. The apprenticeship is awarded to the person scoring highest on this test.

When hiring helpers, employers prefer high school or vocational school graduates. Courses in shop, mathematics, blueprint reading, welding, and machine metalworking are useful. Mechanical aptitude and the manual dexterity needed to handle tools also are important.

Some boilermakers advance to supervisory positions. Because of their broader training, apprentices usually have an advantage in promotion.

Job Outlook

Boilermakers is a very small occupation with limited job prospects. Persons who wish to become boilermakers are likely to face competition, due to the limited number of apprenticeships available and the relatively good wages an experienced boilermaker earns. Employment of boilermakers is expected to show little or no change through the year 2008. Most job openings will result from the need to replace experienced workers who leave the occupation.

Growth should be limited by several factors: The trend toward repairing and retrofitting rather than replacing existing boilers, the use of small boilers, which require less on-site assembly, and automation of production technologies.

Most industries that purchase boilers are sensitive to economic conditions. Therefore, during economic downturns, construction boilermakers may be laid off. However, because maintenance and repairs of boilers must continue even during economic downturns, boilermaker mechanics generally have stable employment.

Earnings

In 1998, the median hourly earnings of boilermakers were about $18.45. The middle 50 percent earned between $15.04 and $22.49. The lowest 10 percent earned less than $11.40 and the highest 10 percent earned more than $25.53.

Apprentices generally start at about 60 percent of journey wages, with wages gradually increasing to the journey wage as progress is made in the apprenticeship. However, wages vary greatly around the country, with higher wages in Northeastern, Great Lakes, and Far Western states than in other areas of the country.

Almost one-half of all boilermakers belong to labor unions. The principal union is the International Brotherhood of Boilermakers. Other boilermakers are members of the International Association of Machinists, the United Automobile Workers, or the United Steelworkers of America.

Related Occupations

Workers in a number of other occupations assemble, install, or repair metal equipment or machines. These occupations include assemblers, blacksmiths, instrument makers, ironworkers, machinists, millwrights, patternmakers, plumbers, sheet-metal workers, tool and die makers, and welders.

Sources of Additional Information

For further information regarding boilermaking apprenticeships or other training opportunities, contact local offices of the unions previously mentioned, local construction companies and boiler manufacturers, or the local office of your State employment service.

For information on apprenticeships and the boilermaking occupation, contact:

☛ American Boiler Manufacturing Association, 950 North Glebe Rd., Suite 160, Arlington, VA 22203-1824.

☛ International Brotherhood of Boilermakers, Iron Ship Builders, Blacksmiths, Forgers and Helpers, 753 State Avenue, Suite 570, Kansas City, KS 66101.

Bricklayers and Stonemasons

(O*NET 87302 and 87305B)

Significant Points

- Opportunities should be excellent because job openings are expected to grow faster than the number of workers being trained.
- Work is usually outdoors, requires lifting heavy bricks and blocks, and sometimes involves working on scaffolds.
- Nearly 3 out of every 10 bricklayers and stonemasons are self-employed.

Nature of the Work

Bricklayers and stonemasons work in closely related trades creating attractive, durable surfaces and structures. The work varies in complexity, from laying a simple masonry walkway to installing an ornate exterior of a high-rise building. *Bricklayers*—also called brickmasons—build walls, floors, partitions, fireplaces, chimneys, and other structures with brick, precast masonry panels, concrete block, and other masonry materials. Additionally, bricklayers specialize in installing firebrick linings in industrial furnaces. *Stonemasons* build stone walls, as well as set stone exteriors and floors. They work with two types of stone—natural cut, such as marble, granite, and limestone, and artificial stone made from concrete, marble chips, or other masonry materials. Stonemasons usually work on nonresidential structures, such as houses of worship, hotels, and office buildings.

When building a structure, bricklayers begin by constructing a pyramid of bricks—called a lead—at each corner of a wall, around which the rest of the bricks are laid. Due to the precision needed, these corner leads are time consuming to erect and require the skills of experienced bricklayers. After the corner leads are complete, less experienced bricklayers fill in the wall between the corners, using a line from corner to corner to guide each *course*, or layer, of brick. Because of the expense associated with building corner leads, an increasing number of bricklayers use corner poles, also called masonry guides, that enable them to build an entire wall at the same time. They fasten the corner poles (posts) in a plumb position to define the wall line and stretch a line between them. This line serves as a guide for each course of brick. Bricklayers then spread a bed of mortar (a cement, sand, and water mixture) with a trowel (a flat, bladed metal tool with a handle), place the brick on the mortar bed, and then press and tap the brick into place. Depending on blueprint specifications, bricklayers either cut bricks with a hammer and chisel or saw them to fit around windows, doors, and other openings. Then, mortar joints are finished with jointing tools for a sealed, neat, uniform appearance. Although bricklayers usually use steel supports, or *lintels*, at window and door openings, they sometimes build brick arches instead , which support and enhance the beauty of the brickwork.

Hod carriers, or *helpers*, are workers who assist bricklayers. These workers mix mortar, set up and move scaffolding, and bring bricks and other materials to the bricklayers.

Stonemasons often work from a set of drawings, in which each stone has been numbered for identification. Helpers may locate and carry these prenumbered stones to the masons. A derrick operator using a hoist may be needed to lift large stone pieces into place.

When building a stone wall, masons set the first course of stones into a shallow bed of mortar. They then align the stones with wedges, plumblines, and levels, and adjust them into position with a hard rubber mallet. Masons continue to build the wall by alternating layers of mortar and courses of stone. As the work progresses, masons remove the wedges, fill the joints between stones, and use a pointed metal tool, called a tuck pointer, to smooth the mortar to an attractive finish. To hold large stones in place, stonemasons attach brackets to the stone and weld or bolt these brackets to anchors in the wall. Finally, masons wash the stone with a cleansing solution to remove stains and dry mortar.

When setting stone floors, which often consist of large and heavy pieces of stone, masons first use a trowel to spread a layer of damp mortar over the surface to be covered. Using crowbars and hard rubber mallets for aligning and leveling, they then set the stone in the mortar bed. To finish, workers fill the joints and wash the stone slabs.

Masons use a special hammer and chisel to cut stone. They cut stone along the grain to make various shapes and sizes, and valuable pieces often are cut with a saw that has a diamond blade. Some masons specialize in setting marble which, in many respects, is similar to setting large pieces of stone. Bricklayers and stonemasons also repair imperfections and cracks, and replace broken or missing masonry units in walls and floors.

Most nonresidential buildings are now built with prefabricated panels made of concrete block, brick veneer, stone, granite, marble, tile, or glass. In the past, bricklayers doing nonresidential interior work mostly built block partition walls and elevator shafts. Now, these workers must be more versatile and work with many materials. For example, bricklayers now install light-weight insulated panels used in new skyscraper construction.